

PRESENTATION TO BLUE-RIBBON PANEL

3/9/01

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Gentlemen:

Good afternoon. My name is Jim Furman and I represent the family of Major Brooks Gruber and the wife and children of Lieutenant Colonel John Brow.

Col. Brow and Maj. Gruber were the pilots of the MV-22 Osprey, call sign Nighthawk 72 on April 8, 2000. Both of these pilots were career Marine officers. They were proud of their service to the Corps as well as to their country.

The families that I represent are also proud Marine families. They believed in the esprit de corps and the brotherhood of Marines. They are not here to condemn the Marine Corps.

Also, they are not here in an attempt to bring an end to the Osprey program. They are here really for 2 purposes: (1) to make sure that what killed the pilots and the 17 other Marines on April 8, 2000 will never happen again; and (2) to clear the record and to correct a wrong.

The pilots of Nighthawk 72 have been unjustly and falsely accused of causing the crash of April 8th, which resulted in the loss of their own lives and the lives of 17 other Marines. This accusation has compounded the grief of Mrs. Gruber and Mrs. Brow and their families, over and above that, which would normally arise out of such a tragic loss.

Euphemisms such as "human factors" have been used.

It is clear from the press releases and statements subsequent to the investigation that these pilots are being accused of operating the aircraft outside of the normal flight envelope and that such operation was

the cause of the crash. In fact, the official position has gone on to exculpate anything having to do with the tiltrotor technology.

It has been said that the April 8, 2000 crash does not implicate the tiltrotor technology. This conclusion is not based on an objective, factual analysis of the -- crash, --the technology and completely misses the mark. It is an attempt to deny the reality that tiltrotor technology is still within its infancy, notwithstanding the fact that it has been the subject of studies and prototypes for many years. Moreover, we believe that what happened on April 8, 2000 is so fundamentally related to the tiltrotor technology that it cannot be ignored. There are abundant factual findings and conclusions in the JAG report that severely implicates the technology.

All of the proof that is necessary to identify the design, testing and lack of adequate warnings as the cause of the

April 8, 2000 crash is contained in the JAG report, the report by Phillip Coyle and the OPEVAL report.

To conclude from the facts presented there -- that the pilots were flying outside of the flight envelope is a denial of reality presented by the facts and a strained and inaccurate interpretation of the limitations presented in the flight manual.

The JAG report states, "after reviewing the evidence collected, it was disconcerting to see how 'easy' it was for the recipe of uncontrolled flight to be concocted."

The JAG report states that what brought the aircraft down on April 8th was the Osprey's unique response to vortex ring state. Vortex ring state is a phenomenon that has been known concerning helicopters for many years. However,

most helicopters have a fairly benign vortex ring state. The JAG report states:

"Though all rotorcraft have the potential to enter a vortex ring condition, recorded occurrences to date have been rare. The fact that this aircraft not only found itself in vortex ring state condition with no apparent warning to the air crew, but also departing controlled flight, is particularly concerning."

The JAG report goes on to find that

"In traditional rotorcraft, power settling would cause uncommanded rates of descent and, depending on altitude, may result in a hard landing or quite possibly a controlled crash. In all likelihood, however, such an event would result in the aircraft at least hitting the ground in an upright attitude."

Most helicopters respond to vortex ring state by a loss of symmetrical lift, which results in increasing rates of descent. Single-rotor and tandem-rotor helicopters can easily recover from a vortex ring state by flying out of the disturbed column of air. However, in the Osprey, if vortex ring state occurs to one rotor to a greater degree than the other, the aircraft will respond by a rapid roll approaching 100 degrees per second. This does not permit the pilot an opportunity to fly out of the condition if he is close to the ground.

The Jag report states:

"(B)ecause of the approximately 8 foot-8 inch distance (between the tips) of its proprotors, ... it is possible to have one rotor impacted by the effects of the vortex ring state and/or blade stall and the other not, resulting in an asymmetrical condition. We believe that this was the case of the mishap.

Though VRS may have been the initiating event, what caused the crash was an uncommanded roll and loss of roll authority. The result is a departure from controlled flight. An uncommanded roll does not necessarily occur as the result of a rapid rate of descent at slow airspeed. An uncommanded roll can occur any time disturbed air changes the angle of attack of the airflow through the rotor system. Besides a steep rate of descent, the helicopter can encounter an uncommanded roll by flying through the wake vortices of a preceding aircraft. In addition, helicopters can encounter uncommanded roll by experiencing the disturbed air that has developed when strong winds encounter terrain, buildings or ships.

Vortex ring state has been known for many years. Pilots are exposed to it while going through pilot training. There are also discussions in most of the helicopter NATOPS manuals.

However, it is not a condition that helicopter pilots will see very often. It is a rare occurrence.

Nothing in the previous training or discussions in those manuals prepared the pilots of Nighthawk 72 for what they encountered that night.

The NATOPS Manual for the Osprey does not even address power settling or vortex ring state. It does address "settling with power", which is found in the emergency procedures section.

According to the Navy flight manuals, "settling with power" is something entirely different than what was encountered by Nighthawk 72.

NATOPS manuals for all other current Marine helicopters have discussions of vortex ring state and settling with power.

The NATOPS Manual for the UH-1N (a Bell Helicopter product) draws a distinction between these phenomena.

The Osprey manual does not mention nor does it provide a procedure for recovery from VRS or power settling.

Though the Osprey manual does include the warning, "avoid descent rates of 800 feet per minute or greater, at airspeeds less than 40 KCAS," it follows that with a procedure for "settling with power". This warning, which not found in the chapter on flight characteristic or normal procedures, is the limitation that has been identified as defining the flight envelope at issue.

I would like to point out that the warning that is given, even if it did apply says "avoid" airspeeds below 40 kts at descent rates greater than 800 fpm. Other NATOPS manuals use more imperative language. In the Bell UH-1N manual it says, "Do Not exceed 800 fpm at airspeeds less than 40 kts."

But as stated before, this limitation is only associated with the discussion on "SETTLING WITH POWER".

Settling with power is defined in the UH-1N NATOPS manual as "a descent caused by the settling of the helicopter while performing a maneuver where power required is greater than power available.... Although most settling with power cases involve low forward airspeeds, it can occur at any airspeed. Settling with power requires either reduced power available, high rate of descent, high gross weight, high density altitude, high G-maneuvering, or some combination thereof.... It is most likely to occur during: (1) a quick stop from a heavy, high speed, low altitude condition while approaching a landing zone, (2) a high gross weight/high density-altitude approach to a landing zone requiring HOGE power and only HIGE power available, (3) tight level turns,

(4) low altitude pull up following a descending turn to a target."

"SETTLING WITH POWER" is when there is just not enough power to do what you want to do. It is like trying to go up a steep hill with an underpowered car.

Settling of power is aerodynamically different from vortex ring state and is not what Nighthawk 72 encountered on April 8, 2000. Therefore, any reference to this warning as some indication that the pilots were operating outside of the flight envelope is inaccurate and false.

The inadequacies of the manual have been noted in Marine reports. The OPEVAL Report states,

"the NATOPS Manual lacked adequate content, accuracy, and clarity. Additionally because of incomplete developmental testing in the high rate of descent regime, there was insufficient explanatory or

emphatic text to warn pilots of the hazards of operating in this area."

Not only was there no discussion in the flight manual, "the flight simulator did not replicate this loss of controlled flight regime."

The pilots were never told about it in the manual and they could fly the simulator in a low speed high rate of descent without experiencing it. Surprisingly the simulators were not even programmed to train the pilots on what we now know was a very dangerous condition.

After reprogramming, post-accident simulation, tests show how razor-thin the edge of the flight envelope is and how it is lacking in any margin of safety. A simulation was done at 39 knots KCAS and 0 feet per minute rate of descent. Pulling the thrust control levers full aft, caused an immediate descent exceeding 800 feet per minute. Forward

application of the thrust control levers resulted in uncontrolled flight. Within 3 seconds the simulator exhibited in excess of 3,000 feet per minute rate of descent.

It is not clear from the documentation that the asymmetrical condition was capable of being duplicated in the simulator.

Such a razor-thin boundary between controlled flight and uncontrolled flight is unacceptable. There is no margin of safety. Compounding this unexpected black hole is the inherent instrument error that occurs at low airspeeds and the inability of a pilot who is flying with night vision goggles to even see the vertical speed indicator. According to the Coyle report:

"The vertical velocity indicator (VVI) ... is poorly located, and uses a varying scale with a relative course incremental markings." ... "Testing today suggests that should a pilot inadvertently exceed published

limitations, there may be no easily recognizable warning that the aircraft is near the danger zone."

"...(T)he first indication a pilot may receive that he has encountered this difficulty is when the aircraft initiates an uncommanded, uncontrolled roll."

It is clear that the pilots had no reason to believe that the aircraft would enter into this uncontrolled state. The flight envelope is poorly defined and non-existent for VRS. No warning was given concerning vortex ring state and no procedure was provided to the pilots. The reason this is so is because this area of the flight envelope was never thoroughly tested by the contractor or explored during developmental flight tests. The Coyle report states,

"Since identifying the boundaries of the vortex ring state danger region involves complex, poorly understood aerodynamics, successful mapping of

this region must be accomplished via a program of flight tests, wind tunnel testing, modeling and simulation."

This was not done with respect to VRS prior to April 8, 2000. If it was, it was never reported to the Marine Corps.

Because of the unique design of the rotor system of the Osprey, this should have been fully studied. The Coyle report states:

"The basic aerodynamic mechanism of VRS is common to all rotorcraft, however, the problem mechanism that initiates the sudden and potentially catastrophic departure mode in the Osprey is unique to side-by-side rotor configuration."

The Coyle report identifies other factors that may contribute to the extreme response of the Osprey aircraft:

- *the proximity of the wing to the rotors affecting the airflow state over the wing in steep descents*
- *the affect of yaw which may cause one rotor to be in VRS and the other rotor on the margin outside of it*
- *large thrust fluctuations from the rotors causing an out-of-phase thrust on the two rotors*
- *wind gusts*
- *wake turbulence.*

Since this aircraft will be flown in harm's way under severe hostile conditions, the Coyle report noted other factors and "flight conditions that place a high workload demand on

the pilot; e.g., night or low visibility, system malfunction, (and) hostile fire."

The reason for the different response to VRS can be traced directly to the unusual configuration of the Osprey's rotor systems. This is the only domestic production aircraft that has two rotors placed side-by-side on pylons at the end of the wings. Secondly, unlike all other helicopters, the rotor systems are not over the centerline of the fuselage. But, unlike two single-rotor helicopters flying side-by-side, if one rotor of an Osprey helicopter encounters a loss of lift, it will have a seesaw affect on the rest of the aircraft and the other rotor system. This seesaw affect results in the loss of control authority as well as an uncommanded and very rapid roll approaching approximately 100 degrees per second. Also unlike conventional helicopters, the uncommanded roll will not have the beneficial effect of

allowing the aircraft to fly out of the column of disturbed air. Instead, the uncommanded roll will cause the Osprey to pivot about its longitudinal axis because of the tremendous amount of thrust and momentum that is being produced off the rotor system on its opposite side. All of these factors were unknown to the crew of Nighthawk 72 on the night of April 8, 2000.

This is not the only loss of roll control incident in an Osprey. There were some other events that exhibited the same symptoms of loss of control authority and uncommanded roll.

It is important note that these other events did not involve a rapid rate of descent at slow airspeed.

Two of these events occurred during OPEVAL when pilots reported experiencing an uncommanded roll during

formation flight. In commenting on this, the JAG report stated,

"(I)t (is) difficult to completely exclude wake turbulence or down-wash as potential contributors to the mishap."

These two separate events occurred while a second Osprey in a flight of two encountered the wake turbulence of the preceding Osprey. In both circumstances, the pilot experienced a rapid onset of an uncommanded roll, which could not be counter-acted by full cyclic taken to the stop. Fortunately, there was sufficient altitude in both cases when the event occurred to allow the pilot to regain control and avoid another catastrophic crash.

There were other events as well of uncommanded roll. One occurred during shipboard operations aboard the USS Saipan where the pilot momentarily lost roll control of the aircraft and the aircraft nearly crashed into the ship. The

two formation flights as well as the event occurring on the Saipan have two common denominators that they share with Nighthawk 72. One, loss of roll authority, and two, the presence of disturbed air.

Wake turbulence from the preceding aircraft accounts for the disturbed air in the formation flights. On shipboard, there is a natural turbulence that occurs as wind diverges over the ship's structure. Turbulent conditions can change the angle of attack that is experienced on one rotor versus the other. A sudden change in angle attack can cause the rotor to buffet possibly resulting in loss of lift. Aggravated and accelerated into the roll by the lift and thrust that is being produced by the opposite rotor may cause the aircraft to crash.

Since Nighthawk 72 was in formation behind Nighthawk 71, it is possible that the wake turbulence from the lead aircraft

was the cause or a contributing cause to the upset and crash.

There are facts concerning the Osprey that are indisputable. The side by side rotor configuration in the Osprey is different. It responds to VRS and other disturbances dramatically different than any other helicopter. No Marine pilot was aware of this dangerous condition prior to April 8, 2000. Certainly Brooks Gruber and John Brow were not.

There is no justifiable way that they can be blamed for the crash. Pilot error is failing to do what a reasonable prudent pilot would have done or doing what a reasonable prudent pilot would not have done under the same or similar circumstances. Under any definition it is not possible to say that they committed pilot error. To say they did would be to

say that they were not reasonably prudent pilots and that the average Marine pilot, faced with the same circumstances would have acted differently.

In order to avoid a problem you have to know about it. No one in the Marine Corps knew that flying a steep approach behind another Osprey would result in the crash that occurred.

Flying a steep approach at a rapid rate of descent is not beyond the capability of all other Marine helicopters. It is a technique that has been used by thousands of helicopter pilots who flew in Vietnam. Sometimes it was the only way that a pilot could avoid being hit by enemy fire. The Osprey is supposed to be a combat aircraft. If it is to fly and survive in combat it must be forgiving enough to allow the pilot to fly it aggressively in any mission assigned to it and come back alive. If it has to be flown with kid gloves and peacetime traffic patterns it will not survive the battlefield.

There have been some who have said that crashes of new aircraft are inevitable; we should expect some losses anytime we develop new technology. With respect, let me say in response to that that --- those who make such observations are never the families who are most directly involved. Secondly, this was supposedly not a prototype aircraft; it was not being flown by test pilots; there was no ejection seat available, especially for the 15 Marine infantrymen who had no choice but to do what they were told to do and whose families are unimpressed with the fact that it was a new aircraft.

An experimental or developmental aircraft should never be loaded with passengers. Test pilots are trained to approach the edge of the flight envelope in a very incremental way so as to anticipate and head off any aberrant behavior of the aircraft. As a last resort, they have their ejection seat to

take them away from the wreckage. These Marines had no such option.

It has also been said that the loss of these two Ospreys and the 23 Marines can be justified because of the civilian market potential of tiltrotor technology. From the perspective of the Marines families who lost loved ones in this needless crash, this is even more of an immoral view. It is not the mission of the United States Marine Corps or our military in general to be the testers, evaluators, promoters and sacrificial lambs on the altar of for-profit commercial activities or to enhance a positive balance of trade. If the technology is sound, viable and provable, it can stand on its own merits. Taxpayer dollars should not be utilized to advance a commercial venture for the benefit of private interests.

The decision on Milestone III/full-rate production was scheduled for December 2000. We now are aware of the allegations of the falsification of maintenance records to make the aircraft appear more maintainable than it was. We are also aware that numerous reports of hydraulic and software problems were not adequately dealt with, which resulted in the tragic loss on December 11, 2000 and the loss of 4 other brave Marines. We know that waivers were granted that could have a direct impact on the safety of the aircraft, including demonstration of autorotation capability, air combat maneuvering, flight in icing conditions, and amphibious operations. Couple this with the political and budget realities, -- that there are only so many defense dollars to be spent, -- makes a troubled aircraft program more susceptible to an environment of -- look for any other cause of a crash other than the product --

the technology. It is the conventional wisdom that pilots cause most crashes; therefore, if there is some basis, whether supported by the facts or not --- to blame the pilots. It may be too much of a temptation not to, when you're trying to save the program.

I encourage you to identify the real culprit – an immature aircraft program that has not been adequately vetted. Before another Marine life is put at risk the Osprey should be fixed and fully tested.

The crash of two Ospreys and the loss of 23 lives have been costly enough. It would be unconscionable to ignore the lesson that can be learned and run the substantial risk that these crashes will happen again.

These Marines pilots gave their lives for their country; they should not have to also give their reputations to save the Osprey program. Their widows, children and families should

not have to bear that shame and well as the grief for their loss.

Thank you for your careful consideration and your service to your country.